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ABSTRACT

The JANUS (Joint Academic Network Using Satellite) satellite network is being planned to link European institutions wishing to jointly produce distance teaching materials. Earth stations with capabilities for transmit/receive functions, voice/data functions, two 64 kbs channels, and connection to local telephone exchange and computer networks will be located at each institution. Initially the European Association of Distance Teaching Universities (EADTU) will form the core of the system, but the network is expected to grow to include enterprises concerned with distance training. JANUS will have several functions: (1) two-way communication between sites; (2) audio-conferencing; (3) electronic mail; (4) computer conferencing; and (5) experimental video-conferencing. JANUS is being designed to reduce travel costs and time, reduce communication costs, speed up joint course production, secure external funding, and improve user-friendliness of electronic messaging and data transfer. Although most functions could be provided by existing services (face-to-face meetings, public telephone systems, public switched packet networks, private data networks, and VSAT satellite networks), there are problems with the cost and quality of service. Issues to be resolved before JANUS becomes operational include earth station design, location of a suitable satellite, development of user-friendly procedures, funding, and regulation of telecommunications services. (MES)

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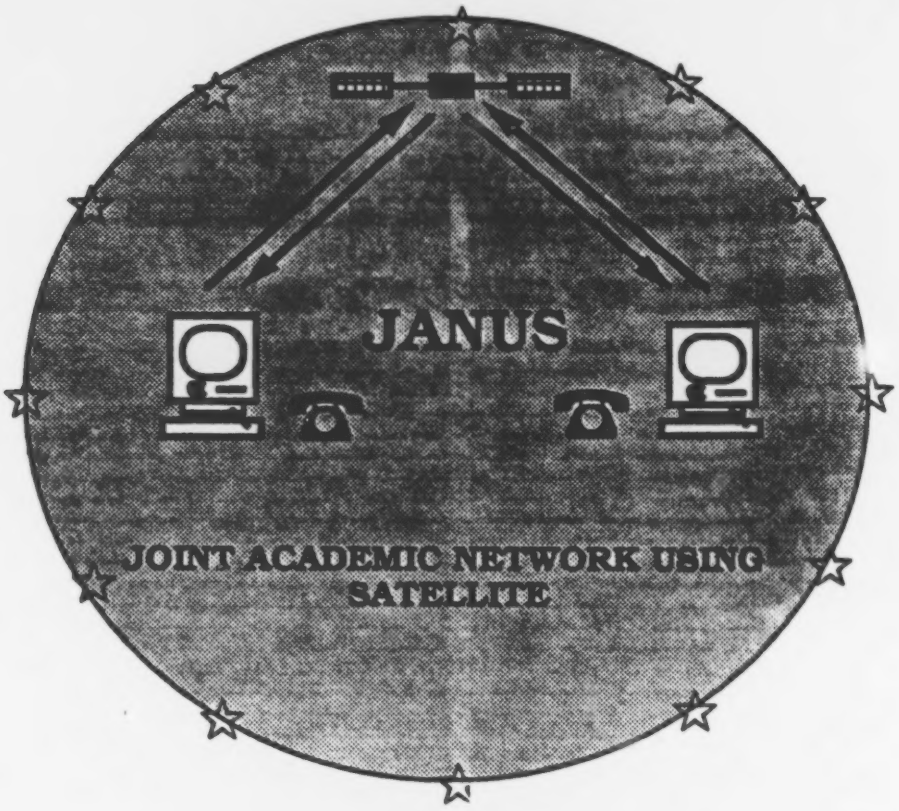

BRIEF DESCRIPTION OF PROJECT

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What is JANUS?

Janus was the Roman god of gates and beginnings, the god who looked two ways. What more appropriate name then (first suggested by John Duke) for a satellite network being planned to provide two-way voice and data communication to link European institutions wishing to jointly produce distance teaching and training materials?

The network is to be based on low-cost, narrow-band two-way earth stations located at each campus/teaching headquarters of institutions in the scheme. The earth stations are being specially designed by Marconi Communications Systems, United Kingdom. Initially, members of the European Association of Distance Teaching Universities will form the core of the system, but it is expected that the network will grow to include enterprises concerned with distance training. The target date for the start of network operation is early 1991.

Functions

The network is planned to have the following functions:

- two-way voice communication between any two sites;
- audio-conferencing across all sites for joint course team, joint research and joint administrative meetings;
- electronic mail facilities for individual messages, the transfer of draft teaching materials, minutes of meetings, and credit and course transfer details, etc.;
- computer conferencing facilities for commenting on and editing (remotely) draft texts/documents across sites;
- an experimental video-conferencing facility at 64 kbs.

The network requires the development of a unique European-designed 'mesh' earth station capable of working either with OLYMPUS and/or ASTRA, or with other European satellites, in particular the forthcoming EUTELSAT II series.

At the moment, JANUS is no more than a proposal, supported by a feasibility study part funded by the European Commission's DELTA programme. The actual implementation of the network will depend not only on the outcome of the feasibility study, but also on funding decisions of individual member institutions of EADTU and SATURN, and on political and technical decisions regarding regulation and satellite frequency allocations.

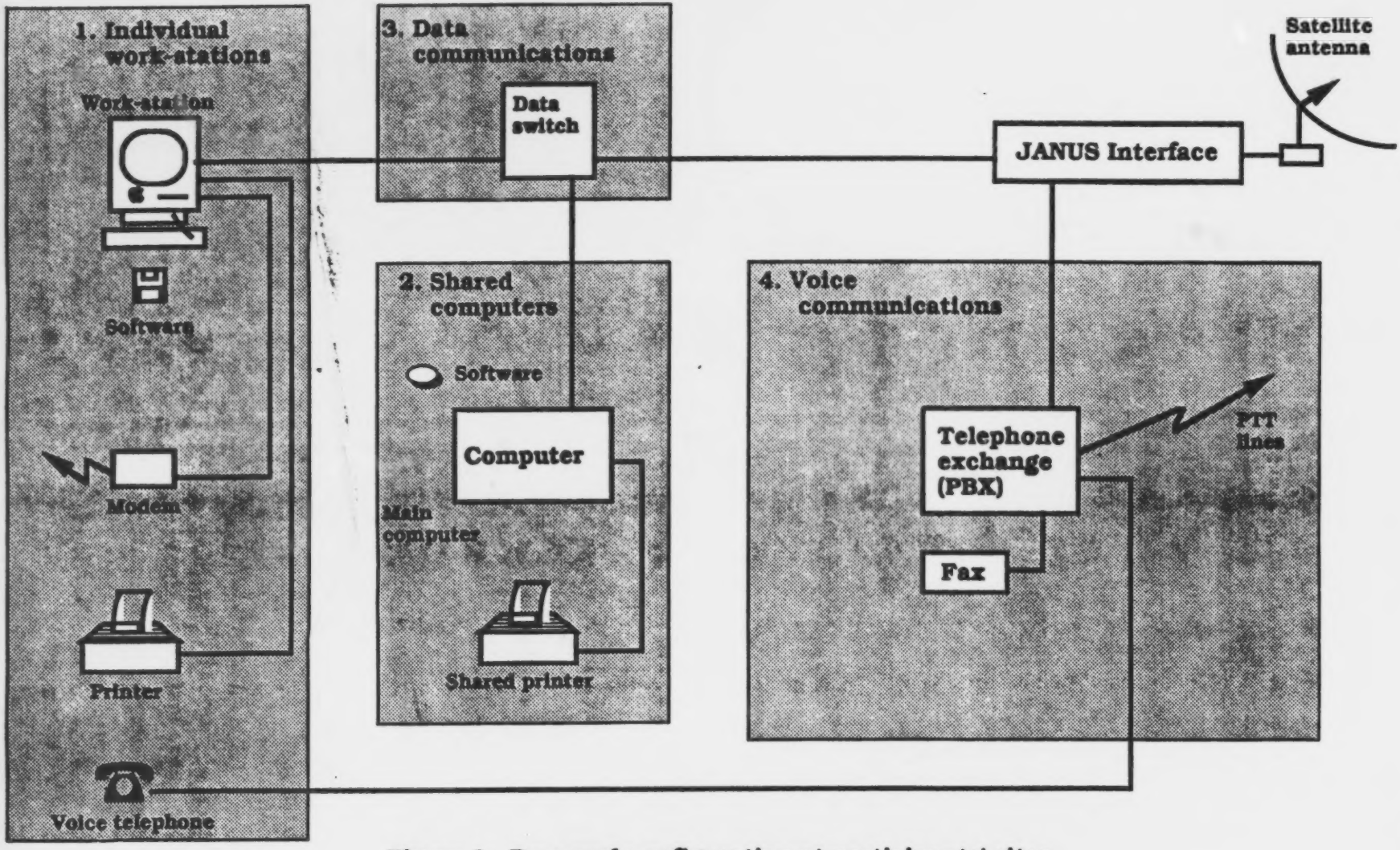

Figure 1: Proposed configuration at participants' sites
(from an original block diagram by Adrian Rawlings, ACS, Open University)

Who would be on the network?

The system is not aimed at direct course delivery to students, but at inter-institutional communication, so will be open to any educational or training institution with a need for communication with other similar institutions. In the first phase, it is anticipated that most EADTU members will join, followed in the second phase by the industrial/ enterprise members of SATURN, although anyone else with an education or training use will be welcome. The joining fee is essentially the decision to purchase an appropriate ground station.

How would the system work?

Each site will have an earth station capable of:

- transmit and receive functions;
- voice and data functions;
- two 64 kbs channels;
- connection to site PABX (local telephone exchange) and computer networks.

Users with networked computer work-stations and office telephones will access the system direct from their offices. Users will 'call up' the facility by dialing in the normal way for voice, or using software to identify data destinations (this may for instance be in the form of a map on a screen for a site, plus a directory of names at that site). Basically, each transmission will contain codes to identify both the destination and the source of the message. Part of the code will route the signal into the earth station rather than the public telephone system, and the earth station will transmit the message with the codes to the satellite. The satellite will re-transmit the signal to all sites, but only the earth station with the appropriate destination code will collect the signal and route it into the site PABX or computer network.

For electronic mail and computer conferencing, data will be stored either on a local computer, or on a remote computer at one of the other sites, to be accessed by users on demand.

For video-conferencing, a simple television studio and additional special equipment for encoding and decoding the video signals (CODECS) will be necessary.

Figure 1 (opposite) summarises the proposed system. The essence of the system is that it by-passes the public telephone and data networks; thus

after the purchase of the equipment, the only recurrent cost is the lease of channel capacity on a satellite equivalent to two 64 kbs channels.

Why a satellite network?

Why does EADTU need such a network? Why cannot it rely on the current system of face-to-face meetings, supplemented by telephone, fax and postal services?

There are several requirements for EADTU institutions wanting to work together. In particular, JANUS is being designed to meet the following requirements for network members:

- to reduce travel and subsistence costs;
- to reduce telephone, fax and data transfer costs;
- to reduce the amount of time spent by staff travelling;
- to speed up the process of joint course production, transfer of documents and administrative decisions across national boundaries;
- to secure external funding from European Commission and national technology development programmes;
- to improve the user-friendliness of electronic messaging, distance editing and data transfer.

Why not use existing services?

First of all, it is necessary to look at the services already provided in Europe, or already available outside Europe:

- face-to-face meetings, involving travel and subsistence;
- terrestrial PTT (public telephone) voice telephone systems;
- terrestrial PTT public switched packet networks for data;
- terrestrial private data networks (JANET, EARN);
- VSAT satellite networks (VSAT = very small aperture terminals).

First of all, it has to be said that all the functions set out for JANUS could be done between most (but not all) EADTU institutions, using existing services. The two main problems with current systems is cost and quality of service, which stem on the one hand from the high cost of European

travel and hotels and on the other from the monopolistic and protected nature of European PTTs.

Face-to-face meetings

There are two main elements to face-to-face meetings: the cost of travel, meals and accommodation; and the time spent travelling to and from meetings in Europe. These costs are not evenly spread; travel and time costs are higher for those living in countries around the edge of Europe; in addition, air costs in particular vary considerably on a per kilometre basis between different countries.

Face-to-face course team or committee meetings commonly last three hours, or half a day. For many participants, though, the actual time spent travelling to and from meetings, can, with the meeting itself, add up to two full days, even if evenings or weekends are used.

On average, each meeting is likely to cost roughly 2,000 ecus per person attending, allowing for two days per person for each meeting. Thus a single committee meeting of 12 EADTU representatives will cost around 20,000 ecus (£15,000) if held on a face-to-face basis.

Cost and quality of PTT telephone services

Some of the problems of using PTT services across Europe have been indicated in Chapter 00. The cost of using point-to-point long-distance international calls in Europe during office hours is more expensive than in North America, and for publicly funded educational institutions, the absolute cost is high as well. International costs vary considerably between European countries, but for instance direct dialled person-to-person calls between Spain and the United Kingdom are 51 pence per minute, or about 45 ecus per hour.

Distance teaching universities are heavy users of telecommunications facilities. Direct telephone charges for the British Open University alone are over 1 million ecus per year. If the costs of student telephone calls and television and radio transmission are added, the figure approaches 3 million ecus. This is without the added costs of widespread European communication.

Particularly expensive is audio-conferencing across national boundaries. Even using specialist companies with access to preferential rates from PTTs, the cost of a three-hour audio conference across 12 sites is almost £2,000, or over 2,600 ecus. Nevertheless, this is still seven times cheaper than a face-to-face meeting.

Public and private data networks

When one talks of 'data', one should not think so much of figures or computer programmes, but of electronic text. EADTU's primary need for joint course production is to be able to move large quantities of text between institutions.

There are two kinds of terrestrial data networks: public and private. Both in fact run through the PTT networks, but private networks lease facilities from the PTTs. Not all member institutions have access to public packet switched networks, although this problem will certainly disappear in the next few years. However, again, public PTT data services such as British Telecom's BT Gold electronic mail system are much more expensive than services on private data networks, such as EARN. EARN (European Acadmic and Research Network) does link up many universities and research establishments in Europe. The reason though why it is so relatively cheap is that it has been heavily subsidised by IBM. There are doubts about the continuation of this subsidy. Again, not all members of EADTU are members of EARN. EUROCOM is an electronic mail and computer conferencing facility being promoted by the European Commission, and developed by University College, Dublin.

Neither the public nor the private data networks (with the possible exception of EUROCOM) are easy to use by untrained people, and apart from EUROCOM, none offers conferencing facilities.

However, it has to be said that data transfer costs are relatively cheap compared to voice costs, and EUROCOM would offer a possibly suitable data service for EADTU, if all members joined. It is the potential cost benefits of *voice* communication which makes a private satellite network so attractive, and once the facilities are available for voice, the data services can easily be added at much lower cost than going through other systems.

VSAT systems

VSAT systems usually use a large, central hub station to link up small, low-cost (around US$15,000) terminals at many points. Figure 2 below shows the configuration of a VSAT hub system (although most systems would have many more small terminals).

Why not use established VSAT technology? First of all, although well-established and very popular in the USA, VSAT systems are not available yet in Europe, although several American companies manufacturing terminals are poised to enter the market, and several national PTTs are 'considering' VSAT networks. The main constraint is that while in America, companies other than PTTs can establish private two-way voice

and data networks, in Europe PTTs still have a monopoly of such services. In any case, new systems will need to be developed to work on the rather different kinds of satellites available in Europe. From the PTT's point of view, why bother to develop a new service that will actually compete with one's own existing terrestrial or satellite services?

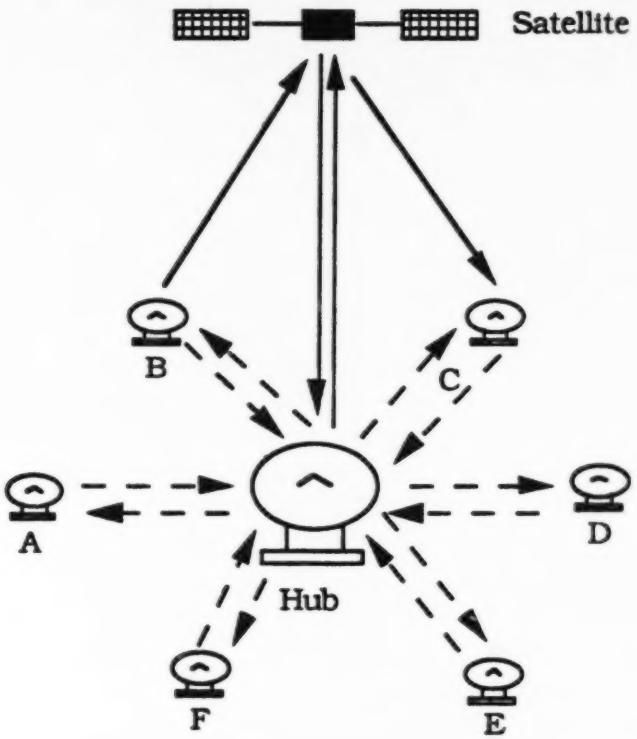

Figure 2: VSAT hub configuration

Changes in the regulatory environment would remove that particular problem. However, VSAT systems make a great deal of economic sense when one has a central head office, and many retail or marketing points; in other words, when all the traffic flows through a central point. The high cost of a hub station is more than set off by the relatively low costs of the small terminals. However, in a system with less than 100 terminals, it may be more economical to develop 'equally powerful' terminals for use at each point, which are much cheaper than the large hub station, but rather more expensive than the small terminals.

Another problem with VSAT systems is that they require a 'double hop' to communicate from one small terminal to another. Thus in Figure 2, for site B to communicate with site C, the signal from B goes via the satellite to the hub station, then back up to the satellite and down to C. While this is fine for data, which is not time dependent, it can cause difficulties for voice, because of the delay between transmission and reception with a double hop.

There is also the socio-political context to be considered. EADTU is a partnership of equal members. Different joint course teams have different institutions involved. There is no central headquarters through which all information flows.

For these reasons, JANUS is based on the concept of a 'mesh' system, where each terminal can directly communicate with any other (see Figure 3 below).

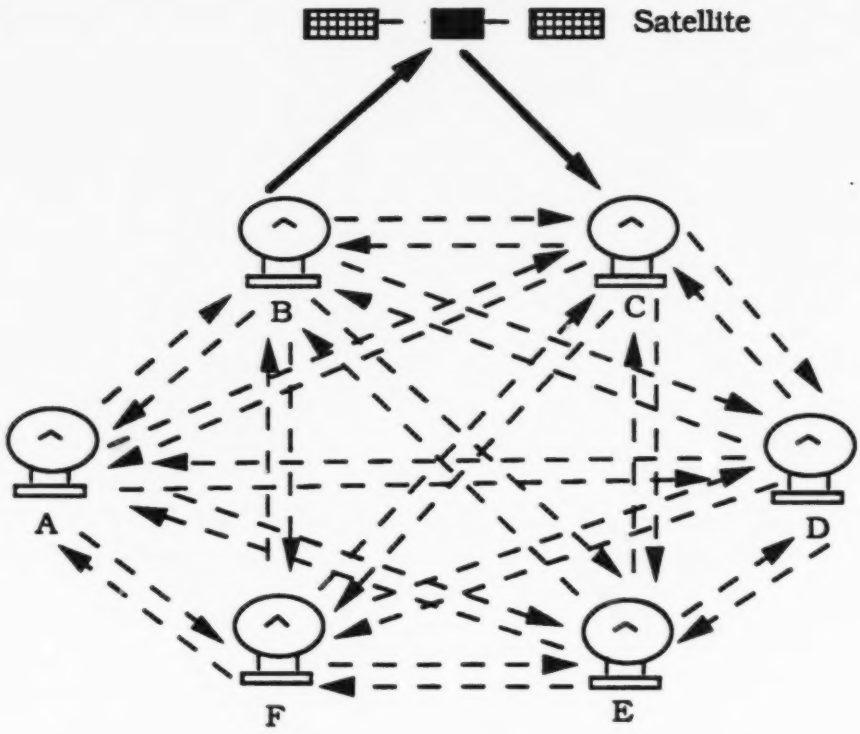

Figure 3: 'Mesh' system (JANUS)

In essence, each terminal is its own 'mini-hub' station, capable of addressing directly any one (or more) of the other terminals, with the advantage of only a single hop for voice communication.

The idea of a private satellite network was initially prompted by the offer of free transmission time on OLYMPUS, to test the feasibility of the system, and by the availability of external funding through the European Commission's DELTA project for new satellite applications for education and training. Eventually, though, any system used by EADTU will have to be fully viable economically, if the system proves useful.

Costs

No firm price for the earth stations is yet available, but for a package of 12 earth stations, an initial estimate suggests an order of magnitude cost

of about 75,000 ecus (£50,000) each. The cost of earth station purchase will have to be found by each participating institution. If OLYMPUS is used, there will be no transmission costs for three years; no figure is available yet for the use of a commercial satellite, but it is likely to be less than £10,000 (15,000 ecus) a year, for the whole system.

Even assuming these rather pessimistic figures it can be seen that if an institution can save between 40-50 journeys, the system will have paid for itself.

The European Commission has, through its DELTA programme, given a grant of 115,000 ecus (£80,000) for a feasibility study during 1989/90.

Problems

It is just as well that there are funds for a feasibility study, since there are some very difficult issues to be resolved before JANUS becomes operational.

First of all, the earth station has still to be designed and built. A major part of the feasibility study is to develop design and cost specifications. Secondly, European Commission grants cover only a maximum of 50% of the cost of projects, and do not include the costs of purchasing equipment. Thus participating institutions will still need to find the bulk of the earth station cost.

Secondly, a suitable satellite to carry the service has to be found. Although the specialised services pay-load on OLYMPUS could technically carry the service, it would mean linking together five different transponders over considerable periods of time, which the ESA does not appear willing to do. The new EUTALSAT II series, due to be launched in 1991, and with a European-wide beam from a single transponder, looks a better bet.

Thirdly, a good deal of work has to be done on developing user-friendly procedures for electronic mail, computer conferencing and remote editing. For the system to work, all users, from secretaries through to Rectors, should be able to use the system after no more than 30 minutes initial introduction. Another major task of the feasibility study is to develop such user-friendly features.

Fourthly, at this stage, some EADTU members remain to be convinced that JANUS is a worthwhile investment, while others are likely to have difficulties in finding the money when it comes to purchasing earth-stations.

Lastly, and perhaps most significantly, the proposed service is currently illegal. In every European country, governments do not allow the PTTs to

be by-passed in the provision of two-way voice or data services. This is quite unlike the USA, where two-way voice and data private business services have been developed as direct competitors to the terrestrial-based telephone companies. This has had several consequences: a massive growth in private satellite business services by new, specialist satellite telecommunications operators; the development by telephone companies themselves of private satellite business services; and a dramatic reduction in telecommunications charges.

The European Commission is anxious to de-regulate telecommunications services in Europe. Satellites provide the opportunity for direct competition with terrestrial services; allowing PTTs to control all satellite communications is like making the bus companies control all air transport. Thus JANUS not only depends on an easing of regulation, but also provides the opportunity for developing new services appropriate for a more deregulated environment, and perhaps most significantly of all, provides a test-bed for the development of European-designed equipment to exploit that new environment.

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